

eMobi Newsletter

An E-RIDES - EV Lab Periodical

इमोबी



भारतीय तंत्रज्ञान संस्था मुंबई^१
भारतीय प्रौद्योगिकी संस्थान मुंबई^२
Indian Institute of Technology Bombay

E-RIDES

Anusandhan National Research Foundation

सी १९७३ ईवी प्रयोगशाला
C1973 EV LAB

Indian Institute of Technology Bombay



Social Media Links:



Empowering Research in Indigenous Development of EV Sub-systems (E-RIDES)

Theme: Power Electronics, Machines & Drives (PEMD)

IIT Bombay has been selected as an e-Node for the project titled

E-RIDES (Empowering Research in Indigenous Development of EV Sub-systems) under the ANRF's MAHA-EV Mission to drive innovation in India's electric mobility sector. The initiative has received ₹60 crore in funding focused on Power Electronics, Machines, and Drives (PEMD), it involves 28 sub-projects, 6 partner institutes, and 22 industry collaborators. The project aims to bridge gap between academic research and industry needs, accelerating the development of next-generation EV technologies in India.

Impact of the Project (KPIs) on Society/Market/ Industry/ Field

1. Indigenous Technology Advancement
2. IP & Knowledge Creation
3. Skill Development
4. Infrastructure and Technology Hub

PARTNER INSTITUTES



IIT Bombay



IIT Delhi



IIT Kanpur



IIT Bhubaneswar



IIT Gandhinagar



SVNIT Surat

MAJOR THEMES



EV Motors



Traction inverters



Off-board
chargers



BMS



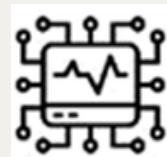
Wireless
chargers



Motor & vehicle
control



Fabrication, packaging of
SiC devices



Reliability of PEMD
components



Policy, assessment
impact

About C1973 EV Lab



C1973 EV Powertrain Lab at IIT Bombay

is a hub for pioneering research and innovation dedicated to revolutionizing the electric vehicle (EV) landscape. The lab focuses on developing advanced solutions to enhance the performance, efficiency, and sustainability of EV powertrains.

Industry-academia partnerships provide educational programs and networking opportunities to cultivate skilled professionals while identifying gaps in the rapidly expanding electric mobility sector.

Lab Services & Facilities

EV Lab hosts an extensive range of resources, including advanced power supplies, diverse battery systems, vertical CNC machining tools, Wire-cut EDM (Electrical Discharge Machining), battery cyclers, high-end oscilloscopes, precision multimeters and other essential electrical measurement equipment. It also features a high-power Motor and Electrical Assembly (MEA) test bench, enabling comprehensive performance validation and optimization of EV powertrain components under real-world conditions.

Our Deliverables



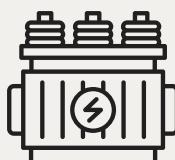
Research & Development

Design and development of power electronics & E-machines (motor, inverter, charger) by aligning with research trends and government policies. Engaging with industry to boost powertrain efficiency, enhance battery management and deploy sustainable mobility solutions.



Education & Talent

Bridging the skill gap by developing courseware, delivering training program, upskilling professionals and nurturing future leaders in the EV sector through experiential learning and case study based projects.



Lab Facilities & Services

Service offering to industry, academia and research associates for best utilization of lab facilities comprising machine, equipment and device.

EV Lab Management

Internal Management Committee



Prof. Sandeep Anand



Prof. Kishore Chatterjee



Prof. Sandip K. Saha



Prof. Bharat K. Suthar

EV Lab Team



Mr. Gopikrishnan T.
Program Director



Abhilasha Sinha
Associate Program Manager
Industry Relations



Divyanshi Patil
Associate Program Manager
Educational Outreach



Maitri Pitroda
Associate Program Manager
PR, Media & Marketing



Aakash Sonawane
Technical Associate
Lab Services

Technical Highlights

At the C1973 EV Powertrain Lab, we are committed to advancing electric vehicle (EV) technologies through industry collaborations and research-led innovation. **Below are some key initiatives:**

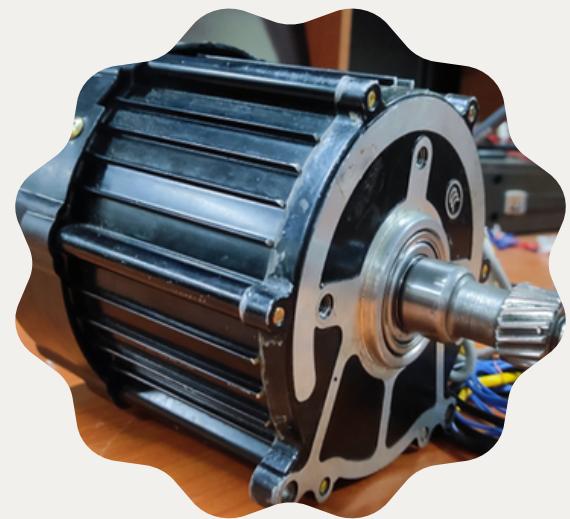
- We design and validate cost-effective, **silicon-based motor controllers** for **electric two and three-wheeler**s, tailored to various power levels and usage profiles, with in-house testing capabilities for evaluating efficiency, thermal performance, reliability, and key features such as **field-oriented control, regenerative braking, and CAN communication**.
- Our lab is focused on addressing reliability challenges in emerging **GaN and SiC devices** by developing **custom gate drivers** for fast fault detection and exploring online condition monitoring techniques for real time control.
- We offer **advanced prototyping solutions** for onboard chargers and motor controllers, integrating next-generation technologies to achieve high power density and energy efficiency for future electric mobility applications
- We work closely with **startups and established OEMs** in the EV sector, and actively support joint research projects focused on localized EV powertrain technology, design for manufacturability, and reliability testing under Indian driving conditions.

Industry Collaboration Offerings and Avenues

Industry Collaboration Offerings

EV Lab actively collaborates with industry players and research establishments to deliver technology solutions that meet the specific needs of the EV market. Our expertise includes:

- Customized Motor and Controller Design:** Tailored solutions to optimize performance and efficiency for diverse EV applications.
- Charger Technologies:** Reliable and efficient designs for both on-board and off-board charging infrastructure.
- Integrated Systems Development:** Compact, multi-functional solutions for powertrain electronics.



Through these collaborations, EV Lab contributes significantly to India's Make-in-India initiative, fostering indigenous development and reducing reliance on imported EV technologies.

Industry Collaboration Avenues



- Transfer-of-Technology**
- Research & Development Projects**
- I-APP Activities & Events**
- Established Student Fellowship**
- Sponsored Projects**
- Corporate Social Responsibility Contributions**
- Educational & Training Programs**

Collaboration Overview

Industrial Academia Partnership Program

Industrial Academia Partnership Program (I-APP), is an EV Lab association Program, designed to provide a platform for collaboration between the C1973 EV Powertrain Lab at IIT Bombay and the industrial partners involved in electric vehicles and their components. The various levels of partnerships are as follows:: 1. Affiliate Partners 2. Associate Partners 3. Principal Partners 4. Sponsor Partners

I-APP Partners



CSR Partners



Sponsor Partners



Education Program

- Short-Term Open Certificate Courses:** These are flexible, short-duration programmes (typically 2 days to 2 weeks), offered either online, on campus at IIT Bombay, or at external venues.
- ePostgraduate Diploma (ePGD):** IIT Bombay's ePGD in E-mobility offers live courses on EV design, batteries, and power systems. Earn 36 ABC credits with an in-person graduation at IIT Bombay.
- PCACEC Courses (for IITB Alumni):** These are short, live online courses (typically under 10 hours) designed to help IITB alumni upskill in their professional careers and maintain a strong connection with the institute.

Inviting CSR Projects

- Advanced battery management systems:** This would include the characterization of battery cells and accordingly determining the charging current, to extend the overall operational life and safety of the battery.
- Advanced Motor Controllers:** GaN based motor controllers for electric 2 & 3-wheelers with reduced sensor requirements. Using advanced technology in power electronics, to reduce the size and increase efficiency of powertrain.
- Magnet-less Motors:** Design and development of magnet-less motors for electric 2 & 3-wheelers. This will reduce dependence on imported permanent magnets and make Indian EV sustainable.

Events and Activities

ECCE Conference 12th May, 2025

The C1973 EV Lab participated in ECCE 2025, where a key highlight was the panel discussion on "Future of Electric Mobility in India." Prof. Sandeep Anand from IIT Bombay shared insights on India's EV roadmap, sparking discussions on innovation, policy, and sustainable mobility.



**ECCE Exhibition - C1973 EV LAB stall
12th May, 2025**

C1973 EV Lab showcased its innovations in electric mobility at IEEE ECCE Asia 2025, Bengaluru. Stall A8 attracted researchers, engineers, and industry experts, sparking insightful conversations and potential collaborations.

At IIT Bombay's 4th CSR Conclave on June 6, C1973 EV Lab presented its latest E-Mobility solutions. The stall engaged CSR leaders, industry experts, and changemakers in discussions on sustainable innovation, opening doors for impactful partnerships and future initiatives.

**I-APP Day on
16TH May, 2025**

C1973 EV Lab hosted the I-APP Workshop on May 16 at IIT Bombay, uniting experts and students for insightful talks, lab tours, and technical sessions—driving collaboration in EV and power electronics.



Overview of Tektronix Wide Bandgap testing solution

The shift from silicon to wide bandgap semiconductors like SiC and GaN is driven by their superior efficiency and high-power performance, making them ideal for EVs, chargers, renewable energy systems, and industrial power supplies. SiC, with its ability to operate at high voltages, is increasingly used in electric vehicle (EV) powertrains. In contrast, GaN is favoured for its efficiency in high-frequency applications, such as fast chargers for laptops, smartphones, and other consumer electronics. The power-electronic systems are based on switching of power semiconductor devices by applying control signals to control the flow of current. Hence system validation in-circuit testing is critical for designers which otherwise overlooks the PCB effects during characterization.

The Double Pulse Test (DPT) is a widely adopted industry-standard method for evaluating key switching parameters during turn-on, turn-off, and reverse recovery events. The power switch may be based on silicon (Si), silicon carbide (SiC), or gallium nitride (GaN) technologies, including MOSFETs and IGBTs. DPT provides several critical measurements to help validate and optimize power converter designs.

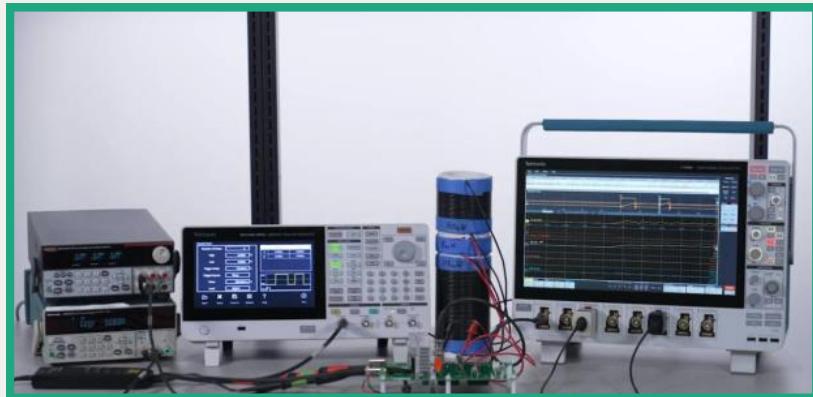
Tektronix offers advanced Oscilloscope based solution with a suite of measurements such as Dynamic RDS(on), Qoss, AFG31K-based gate control, and WBG-specific Deskew, along with numerous automated tests aligned with JEDEC and IEC standards—plus support for custom test limits to validate new designs. We are active members of JEDEC workgroup meetings.

Tektronix offers best in class current and voltage probes like TICP series, TIVP, THDP, TMPD, TPP0850, and TPP1000 for accurate high-voltage VDS and drain current measurements.

- Double Pulse Test (DPT): IEC 60747-9 (IGBT), JEP182 and IEC 60747-8 (MOSFET)
- Diode Reverse Recovery: JESD24-10 and IEC 60747-9

These key measurements for high- and low-side power device testing.

Category	Measurements
Switching Parameter Analysis	Eon, Eoff, Vpeak, Ipeak RDS(on)
Switching Timing Analysis	Td(on), Td(off), Tr, Tf, Ton, Toff, d/dt, Tdt
Diode Recovery Analysis	Trr, Qrr, Err, Irrm, Diode d/dt
Capacitance Analysis	Qoss



Tektronix has delivered numerous industry / technical sessions at premier conferences APEC & PCIM. The technical papers are published as part of IEEE.

- A method to de-skew probes and estimate power loop inductance of WBG-DPT circuits. < <https://ieeexplore.ieee.org/document/10131563/> >
- Design Challenges and Considerations for Gate Drivers of SiC MOSFETS and their Testing | VDE Conference Publication | IEEE Xplore < <https://ieeexplore.ieee.org/document/10653827> >
- Computation of Dynamic Rds(ON) for WBG Devices Using Mathematical Modelling on Oscilloscope < Presented in May 2025, yet to be published >

Summary, WBG system testing is vital for EVs to ensure reliable, efficient operation of high-voltage, high-speed power devices like IGBT's, SiC and GaN.

Reference(s):

- Wide Bandgap – Double Pulse Test Analysis (<https://shorturl.at/Ho1YZ>)



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